

REMARKS

Reconsideration of the application is requested.

Claims 1, and 3-24 are now in the application. Claims 1, 3-9, and 20-22 are subject to examination and claims 10-19 have been withdrawn from examination. Claim 20 has been amended. Claims 23 and 24 have been added. Support for the new claims may be found in numerous locations of the specification, such as within the paragraph starting on line 11 of page 20.

In item 1 on page 2 of the above-identified Office Action, claims 20-22 have been rejected as being indefinite under 35 U.S.C. § 112, first paragraph.

More specifically, the Examiner states that there is no support for "an insulation layer disposed between said dielectric layer, said barrier layer, and said insulation collar." The Examiner's suggested corrections have been made. Support for these changes may be found in Fig. 3B and on pages 23-24 of the specification of the instant application. For example, on page 23 starting at line 15 the specification discloses: "the conductive material of which the barrier layer 167 is composed is oxidized locally on its uncovered surface, thereby producing the insulating oxide region 167'."

It is accordingly believed that the specification and the claims meet the requirements of 35 U.S.C. § 112, first paragraph. The above noted changes to the claims are provided solely for the purpose of satisfying the requirements of 35 U.S.C. § 112. The changes are neither provided for overcoming the prior art nor do they narrow the scope of the claim for any reason related to the statutory requirements for a patent.

In item 2 on page 2 of the above-identified Office Action, claims 1, 3, and 9 have been rejected as being obvious over U.S. Patent No. 5,937,296 to Arnold (hereinafter '296) in view of U.S. Patent No. 4,949,138 to Nishimura (hereinafter '138) and further in view of U.S. Patent No. 6,180,480 to Economikos (hereinafter '480) under 35 U.S.C. § 103(a).

As will be explained below, it is believed that the claims were patentable over the cited art in their original form and, therefore, the claims have not been amended to overcome the references.

Before discussing the prior art in detail, it is believed that a brief review of the invention as claimed, would be helpful. Claim 1 calls for, *inter alia*, a trench capacitor including:

a trench formed within a substrate;

the trench having a conductive trench filling formed of tungsten-containing material disposed in upper and lower regions of the trench.

Newly added claim 23 calls for, *inter alia*, the trench capacitor according to claim 1, wherein the conductive trench filling is at least in the lower part of the trench entirely formed from a material which is selected from a group consisting of tungsten-nitride, tungsten-silicide, and pure tungsten.

Claim 20 calls for, *inter alia*, a trench capacitor including:

a trench formed within a substrate having an upper region and a lower region; and

a conductive trench filling formed of tungsten-containing material disposed in the upper and lower regions of the trench.

The new claim 24 calls for, *inter alia*, the trench capacitor according to claim 20, wherein the conductive trench filling in at least the lower part of the trench is entirely formed

from a material which is selected from a group consisting of tungsten-nitride, tungsten-silicide, and pure tungsten.

The '480 reference discloses a trench capacitor with germanium or silicon-germanium alloy as a trench fill material. With respect to Fig. 6, '480 shows that germanium and silicon-germanium alloys "can be used as a fill for a trench having metal layers to increase conductivity within the trench" (col. 6, lines 14-17). Lines 29 to 39 of col. 6 further explain that the aforementioned metal layer is deposited by a CVD or PVD process in order to provide a thin film of tungsten. The deposited tungsten film layer can have a low thickness of approximately 200 Ångstrom. Even a nonconformal film of tungsten is acceptable. The fill material is then applied after the tungsten layer, which already lines the inner surface of the trench (col. 6, lines 41 and 42).

In contrast, the invention of the instant application can be formed from tungsten-nitride, tungsten-silicide, or pure tungsten. As explained in the specification of the instant application on page 20, line 11 to page 21 line 5, the entire conductive trench filling is formed from tungsten or a tungsten-compound. Thus the trench filling of the instant application is substantially different from the trench filling described in the '480 reference. For example the

'480 reference requires several intermediate process steps to achieve a conductive trench filling, including the deposition of a thin tungsten film layer prior to applying the fill material.

Clearly, '480 does not show a conductive trench filling "formed of tungsten-containing material" as recited in claims 1 and 20 of the instant application. More specifically, '480 does not teach or suggest a conductive trench filling that is "entirely formed from a material selected from a group consisting of tungsten-nitride, tungsten-silicide, and pure tungsten" as recited in claims 23 and 24.

Similarly, '296 and '138 do not disclose using a conductive trench filling "formed of tungsten-containing material" as recited in claims 1 and 20 of the instant application. '296 does not use tungsten within the trench capacitor and only uses tungsten as part of a layer (52 or 152) of highly conductive metallic silicide (e.g., tungsten silicide) that lowers the resistance of the layer. Similarly, tungsten is only mentioned in the '138 reference for use in forming the dielectric film formed between the two electrodes immediately over the source region.

Contrary to the assertion of the Office Action on page 4, tungsten containing material is not suggested as a fill

material by the '480 reference. Rather '480 suggests that the fill material is "selected from the group consisting of germanium and silicon-germanium alloy." Moreover, there is no suggestion in either '296 or '138 that "tungsten-containing material" may be substituted for germanium or silicon-germanium alloy.

In the last paragraph on page 4 of the Office Action, claims 4-8 have been rejected as being obvious over '296 in view of '138, '480 and further in view of U.S. Patent No. 6,277,681 to Wallace, et al. (hereinafter ''681) under 35 U.S.C. § 103(a).

As will be explained below, it is believed that the claims were patentable over the cited art in their original form and, therefore, the claims have not been amended to overcome the references.

In addition to the fact that the Office Action improperly relies on the '480 reference to provide the necessary teachings regarding a conductive trench filling made from a "tungsten-containing material" to make the obviousness rejection of claims 4-8, the Office Action fails to establish a reasonable expectation of success in applying the barrier layers taught by '681 to a trench capacitor as described in '296, in view of '138 and '480. MPEP 2143.02 requires that

the proposed modification or combination of the prior art must have a reasonable expectation of success at the time the invention was made. *Ex parte Erlich*, 3 USPQ2d 1011 (Bd. Pat. App. & Inter. 1986). Thus there should be some indication, outside of the instant application, that '681 could be applied to trench devices in the manner described by '681.

It is accordingly believed to be clear that none of the references, whether taken alone or in any combination, either show or suggest the features of claims 1 or 20. Claims 1 and 20 are, therefore, believed to be patentable over the art. The dependent claims are believed to be patentable as well because they all are ultimately dependent on either claim 1 or claim 20.

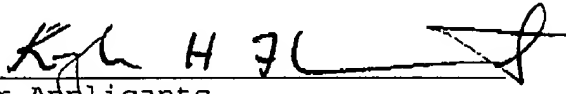
In view of the foregoing, reconsideration and allowance of claims 1, 3-9, and 20-24 are solicited.

In the event the Examiner should still find any of the claims to be unpatentable, counsel would appreciate receiving a telephone call so that, if possible, patentable language can be worked out.

Petition for extension is herewith made. The extension fee for response within a period of one month pursuant to Section 1.136(a) in the amount of \$110.00 in accordance with Section

1.17 is enclosed herewith. Please charge any other fees that might be due with respect to Sections 1.16 and 1.17 to the Deposit Account of Lerner and Greenberg, P.A., No. 12-1099.

Respectfully submitted,


For Applicants

Kyle H. Flindt
Reg. No. 42,539

KHF:cgm

August 29, 2003

Lerner and Greenberg, P.A.
P.O. Box 2480
Hollywood, Florida 33022-2480
Tel.: (954) 925-1100
Fax: (954) 925-1101